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APPLICATION NO.	FILING DATE	FIRST NAMED INVENTOR	ATTORNEY DOCKET NO.	CONFIRMATION NO.
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10/583,641

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Julien Gatineau

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AIR LIQUIDE

Intellectual Property

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HOUSTON, TX 77056

EXAMINER

BLAN, NICOLE R

ART UNIT

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1792

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**Please find below and/or attached an Office communication concerning this application or proceeding.**

The time period for reply, if any, is set in the attached communication.

<b>Office Action Summary</b>	Application No. 10/583,641	Applicant(s) GATINEAU ET AL.	
	Examiner NICOLE BLAN	Art Unit 1792	

**-- The MAILING DATE of this communication appears on the cover sheet with the correspondence address --**

**Period for Reply**

A SHORTENED STATUTORY PERIOD FOR REPLY IS SET TO EXPIRE 3 MONTH(S) OR THIRTY (30) DAYS, WHICHEVER IS LONGER, FROM THE MAILING DATE OF THIS COMMUNICATION.

- Extensions of time may be available under the provisions of 37 CFR 1.136(a). In no event, however, may a reply be timely filed after SIX (6) MONTHS from the mailing date of this communication.
- If NO period for reply is specified above, the maximum statutory period will apply and will expire SIX (6) MONTHS from the mailing date of this communication.
- Failure to reply within the set or extended period for reply will, by statute, cause the application to become ABANDONED (35 U.S.C. § 133). Any reply received by the Office later than three months after the mailing date of this communication, even if timely filed, may reduce any earned patent term adjustment. See 37 CFR 1.704(b).

**Status**

- 1) ☒ Responsive to communication(s) filed on 20 June 2006.
- 2a) ☐ This action is **FINAL**.                      2b) ☒ This action is non-final.
- 3) ☐ Since this application is in condition for allowance except for formal matters, prosecution as to the merits is closed in accordance with the practice under *Ex parte Quayle*, 1935 C.D. 11, 453 O.G. 213.

**Disposition of Claims**

- 4) ☒ Claim(s) 11-20 is/are pending in the application.
- 4a) Of the above claim(s) \_\_\_\_\_ is/are withdrawn from consideration.
- 5) ☐ Claim(s) \_\_\_\_\_ is/are allowed.
- 6) ☒ Claim(s) 11-20 is/are rejected.
- 7) ☐ Claim(s) \_\_\_\_\_ is/are objected to.
- 8) ☐ Claim(s) \_\_\_\_\_ are subject to restriction and/or election requirement.

**Application Papers**

- 9) ☐ The specification is objected to by the Examiner.
- 10) ☒ The drawing(s) filed on 6/20/2006 is/are: a) ☒ accepted or b) ☐ objected to by the Examiner.  
Applicant may not request that any objection to the drawing(s) be held in abeyance. See 37 CFR 1.85(a).  
Replacement drawing sheet(s) including the correction is required if the drawing(s) is objected to. See 37 CFR 1.121(d).
- 11) ☐ The oath or declaration is objected to by the Examiner. Note the attached Office Action or form PTO-152.

**Priority under 35 U.S.C. § 119**

- 12) ☒ Acknowledgment is made of a claim for foreign priority under 35 U.S.C. § 119(a)-(d) or (f).
- a) ☒ All    b) ☐ Some \*    c) ☐ None of:
1. ☐ Certified copies of the priority documents have been received.
  2. ☐ Certified copies of the priority documents have been received in Application No. \_\_\_\_\_.
  3. ☒ Copies of the certified copies of the priority documents have been received in this National Stage application from the International Bureau (PCT Rule 17.2(a)).

\* See the attached detailed Office action for a list of the certified copies not received.

**Attachment(s)**

- |  |   |
|--|---|
| 1) <input checked="" type="checkbox"/> Notice of References Cited (PTO-892)            | 4) <input type="checkbox"/> Interview Summary (PTO-413)           |
| 2) <input type="checkbox"/> Notice of Draftsperson's Patent Drawing Review (PTO-948)   | Paper No(s)/Mail Date. _____                                      |
| 3) <input checked="" type="checkbox"/> Information Disclosure Statement(s) (PTO/SB/08) | 5) <input type="checkbox"/> Notice of Informal Patent Application |
| Paper No(s)/Mail Date <u>06202006_03272007</u> .                                       | 6) <input type="checkbox"/> Other: _____                          |

## DETAILED ACTION

### *Claim Rejections - 35 USC § 112*

1. Claim 11 recites the limitation "... wherein at least the surface region of the ruthenium-type deposit ..." in line 4. There is insufficient antecedent basis for this limitation in the claim.
2. Claim 18 recites the limitation "... monitoring the concentration of volatile ruthenium oxide." in line 2. There is insufficient antecedent basis for this limitation in the claim.

### *Claim Rejections - 35 USC § 102*

3. The following is a quotation of the appropriate paragraphs of 35 U.S.C. 102 that form the basis for the rejections under this section made in this Office action:

A person shall be entitled to a patent unless –

(e) the invention was described in (1) an application for patent, published under section 122(b), by another filed in the United States before the invention by the applicant for patent or (2) a patent granted on an application for patent by another filed in the United States before the invention by the applicant for patent, except that an international application filed under the treaty defined in section 351(a) shall have the effects for purposes of this subsection of an application filed in the United States only if the international application designated the United States and was published under Article 21(2) of such treaty in the English language.

4. **Claims 11, 13-16, and 18 are rejected under 35 U.S.C. 102(e) as being anticipated by Nakahara et al. (U.S. Patent 6,537,461, hereinafter '461).**

Claim 11: '461 teaches a method for cleaning a CVD reactor [reads on "film-forming apparatus"] in order to remove a ruthenium-type deposit residing on the chamber with in the reactor after the reactor was used to form a film ruthenium oxide, wherein the chamber of the reactor comprises ruthenium oxide [col. 3, lines 6-67; col. 4, lines 1-39], said method being characterized by converting RuO<sub>2</sub>(s) and Ru(s) to the volatile RuO<sub>4</sub>(g) by contacting with ozone and a reducing gas such as hydrogen. Since RuO<sub>2</sub>(s) does not react easily with ozone, it is first

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converted to Ru(s) by the reducing gas, and then reacted with ozone to form RuO<sub>4</sub>(g). The volatile RuO<sub>4</sub>(g) is then removed from the chamber [col. 3, lines 64-67; col. 4, lines 1-49; Example 3 running from cols. 12-14].

Claims 13 and 16: The method of claim 11, in which '461 also teaches that the temperature during the cleaning process was about 150 °C to ensure satisfactory etching [col. 13, lines 5-8 and 53-58].

Claim 14: The method of claim 11, in which '461 also teaches that the gas pressure was at 100 Torr [col. 13, lines 14-15].

Claim 15: The method of claim 11, in which '461 also teaches that the oxidizing gas comprises ozone-containing oxygen gas that originated from an ozonizer [reads on "ozone generator"; col. 7, lines -14; col. 14, lines 1-11].

Claim 18: The method of claim 11, in which '461 also teaches that detection of cleaning endpoint was made by providing a sampling point and measuring changes in the ion intensity [reads on "concentration"] of reaction product gas generated during the cleaning [col. 13, lines 16-19] and that the time when the change in the intensity became very small due to increasing ion intensity of RuO<sub>4</sub> (volatile ruthenium oxide) was deemed to be a cleaning endpoint [col. 13, lines 20-22].

### ***Claim Rejections - 35 USC § 103***

5. The following is a quotation of 35 U.S.C. 103(a) which forms the basis for all obviousness rejections set forth in this Office action:

(a) A patent may not be obtained though the invention is not identically disclosed or described as set forth in section 102 of this title, if the differences between the subject matter sought to be patented and the prior art are such that the subject matter as a whole would have been obvious at the time the invention was made to a person

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having ordinary skill in the art to which said subject matter pertains. Patentability shall not be negated by the manner in which the invention was made.

6. The factual inquiries set forth in *Graham v. John Deere Co.*, 383 U.S. 1, 148 USPQ 459 (1966), that are applied for establishing a background for determining obviousness under 35 U.S.C. 103(a) are summarized as follows:

1. Determining the scope and contents of the prior art.
2. Ascertaining the differences between the prior art and the claims at issue.
3. Resolving the level of ordinary skill in the pertinent art.
4. Considering objective evidence present in the application indicating obviousness or nonobviousness.

7. **Claim 12 is rejected under 35 U.S.C. 103(a) as being unpatentable over '461 as applied to claim 11 above, and further in view of Jelenkovic et al. (Degradation of RuO<sub>2</sub> thin films in hydrogen atmosphere at temperatures between 150 and 250 °C).**

Claim 12: '461 teaches the limitations of claim 11 above. '461 teaches that a mixture of an ozone-containing oxygen gas is further admixed with a reductive gas such as hydrogen as discussed in claim 11 above, but '461 does not explicitly teach the amount of hydrogen in the reducing gas. However, Jelenkovic teaches that a reducing gas comprising 1% hydrogen is effective in reducing RuO<sub>2</sub> (solid ruthenium oxide) to Ru (ruthenium metal) on [abstract; page 50 under the *Experiment* section]. It would have been obvious to one of ordinary skill in the art at the time the invention was made to use the amount of hydrogen taught by Jelenkovic in the method of cleaning disclosed by '461 with a reasonable expectation of success because Jelenkovic teaches that it is a suitable amount for reducing RuO<sub>2</sub> to Ru.

**8. Claim 17 is rejected under 35 U.S.C. 103(a) as being unpatentable over '461 as applied to claim 11 above, and further in view of Nakahara et al. (U.S. PGPub 2003/0037802, hereinafter '802).**

Claim 17: '461 teaches the limitations of claim 11 above. '461 does not explicitly teach where the contact between the ruthenium-type deposit and oxidizing gas is carried out after the reducing species has been exhausted off. However, '802 teaches a similar process for cleaning a CVD apparatus in order to remove a ruthenium-type deposit as well as teaches even when a purging process [reads on "exhausted off"] with an inert gas was carried out between the cleaning with ozone gas and the hydrogen containing gas, similar effects were provided [pages 5-6, paragraph 99-101]. It would have been obvious to one of ordinary skill in the art at the time the invention was made to use the purging process taught by '802 in the method disclosed by '461 with a reasonable expectation of success because '802 teaches that similar cleaning results will occur should a purging process be utilized between cleaning with ozone gas and a hydrogen containing gas.

**9. Claims 19-20 are rejected under 35 U.S.C. 103(a) as being unpatentable over '461 as applied to claim 11 above, and further in view of Phillips et al. (U.S. Patent 6,458,183, hereinafter '183).**

Claim 19: '461 teaches the limitations of claim 11 above. '461 does not explicitly teach heating the  $\text{RuO}_4(\text{g})$  gas stream flowing out of the reactor. However, '183 teaches heating  $\text{RuO}_4(\text{g})$  in a collection vessel to convert the volatile product ( $\text{RuO}_4(\text{g})$ ) into  $\text{RuO}_2(\text{s})$  [col. 5, lines 5-10]. It would have been obvious to one of ordinary skill in the art at the time the

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invention was made to heat the vessel containing the volatile ruthenium oxide to decompose it into a less harmful substance for an easier and more eco-friendly disposal.

Claim 20: '461 teaches the limitations of claim 11 above. '461 does not explicitly teach contacting the  $\text{RuO}_4(\text{g})$  containing stream with a decomposition catalyst comprising either  $\text{Ru}(\text{s})$  or  $\text{RuO}_2(\text{s})$  in order to decompose  $\text{RuO}_4(\text{g})$ . However, '183 teaches heating  $\text{RuO}_4(\text{g})$  in a collection vessel to convert the volatile product ( $\text{RuO}_4(\text{g})$ ) into  $\text{RuO}_2(\text{s})$  [col. 5, lines 5-10]. Once the initial particles begin to change into  $\text{RuO}_2(\text{s})$ , they will adhere to the wall [reads on "catalyst"]. The particles that first adhere to the wall will become the catalyst for the rest of the  $\text{RuO}_4(\text{g})$  steam that enters the vessel. Therefore, the gas stream is converted to a solid product for an easier and less harmful disposal. It would have been obvious to one of ordinary skill in the art at the time the invention was made to heat the vessel containing the volatile ruthenium oxide to decompose it into a less harmful substance for an easier and more eco-friendly disposal.

### ***Conclusion***

Any inquiry concerning this communication or earlier communications from the examiner should be directed to NICOLE BLAN whose telephone number is (571)270-1838. The examiner can normally be reached on Monday - Thursday 8-5 and alternating Fridays 8-4.

If attempts to reach the examiner by telephone are unsuccessful, the examiner's supervisor, Michael Cleveland can be reached on 571-272-1418. The fax phone number for the organization where this application or proceeding is assigned is 571-273-8300.

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Information regarding the status of an application may be obtained from the Patent Application Information Retrieval (PAIR) system. Status information for published applications may be obtained from either Private PAIR or Public PAIR. Status information for unpublished applications is available through Private PAIR only. For more information about the PAIR system, see <http://pair-direct.uspto.gov>. Should you have questions on access to the Private PAIR system, contact the Electronic Business Center (EBC) at 866-217-9197 (toll-free). If you would like assistance from a USPTO Customer Service Representative or access to the automated information system, call 800-786-9199 (IN USA OR CANADA) or 571-272-1000.

/N. B./

Examiner, Art Unit 1792

/Alexander Markoff/

Primary Examiner, Art Unit 1792